WHAT IS CLAIMED IS:

1. A data processing method, wherein:

digital data is processed in bytes to constitute one information data block in ($M \times N$) bytes of M rows and N columns;

data is arranged in bytes in the information data block, so that data is arranged in the data transmission order from the 0th column to the (N-1)-th column for each row while data is arranged in the data transmission order from the 0th row to the (M-1)-th row;

($K \times M$) rows $\times$ N columns matrix block is further arranged which is a set of the information data block, and which is constituted of K information data blocks composed of information data blocks from the 0th information data block to the (K-1)-th information data block which continue in the data transmission order;

on each column of ($K \times M$) bytes of the matrix block an error-correcting word PO-a ($K \times Q$) or PO-a ($(K/2) \times Q$) bytes is created at least with respect to only even-number data ($K \times M/2$) bytes, and an error-correcting word PO-b ($K \times Q$) or PO-b ($(K/2) \times Q$) bytes is created at least with respect to only odd-number data ($K \times M/2$) bytes;

PO-a and PO-b is scattered and arranged into K information data blocks which is constituted of ($M \times N$) bytes of M rows and N columns;

each column of N columns is formed as (K × (M + Q)) or (K × (M + 2Q)) bytes of Reed-Solomon code PO (Q is an integer of 1 or more); and

the error-correcting word P bytes is further added for each row of N bytes and each row of (K × (M +Q)) or (K × (M + 2Q)) rows is formed as (N + P) byte Reed-Solomon code PI;

whereby as an overall block an error-correcting product code block is realized which constitutes (K × (M + Q) × (N + P)) or (K × (M + 2Q) × (N + P)) bytes Reed-Solomon error-correcting word having K information data block of (K × M × N) bytes as information portion.

2. The data processing method according to claim 1, wherein:

digital data is processed in bytes to constitute one information data block in (M × N) bytes of M rows and N columns; and

data is arranged in bytes in the information data block, so that data is arranged in the data transmission order from the 0th column to the (N-1)-th column for each row while data is arranged in the data transmission order from the 0-th row to the (M-1)-th row while identification data (ID) and control data are arranged at the first row.

3. The data processing method according to any of claim 1 or 2, wherein the formation of (N + P) bytes

Reed-Solomon code PI is such that in the creation of PI series of information data block to which an error-correcting word PO is added which has rows from the 0-th column to the ((N + P) -1)-th which are composed of the 0-th row to the (M-1)-th row,

each row and each column are increased on the basis of the byte data of each front column to rotate and arrange the row number (M) obtained as a result of increase to move to the 0th row when the increase result of the row becomes (M)-th row thereby constituting (M) sets of PI series error code.

4. The data processing method according to any of claims 1 through 3, wherein K = 32, Q = 1, and PO-a = PO-b = 16 are set, and the sum of one information data block (M × N) bytes and the average word byte number to be added thereto becomes a definite value of (M + 1) × (N + P) bytes.

5. The data processing method according to any of claims 1 through 3, wherein K = 16, Q = 1, and PO-a = PO-b = 16 are set, and the sum of one information data block (M × N) bytes and the average word byte number to be added thereto becomes a definite value of (M + 2) × (N + P) bytes.

6. A data processing method, wherein:

digital data is processed in bytes to constitute one information data block in (M × N) bytes of M rows × N columns;

data is arranged in bytes in the information data block, so that data is arranged in the data transmission order from the 0th column to the (N-1)-th column for each row while data is arranged in the data transmission order from the 0-th row to the (M-1)-th row;

(K × M) rows × N columns first error-correcting block is further arranged which is a set of the information data block, and which is constituted of K information data blocks composed of information data blocks from the 0-th information data block to the (K-1)-th information data block which continue in the data transmission order; and

a block for the creation of (K × M) × N bytes PO series error-correcting word composed of (K × M) rows × N columns is constructed with the even-number row data of the first error-correcting processing block and the odd-number row data of the second error-correcting processing block before one block;

(K × Q) bytes error-correcting word PO on each column created here is scattered and arranged in K information data blocks of the first error-correcting processing block, and each column of N columns is formed as (K × (M + Q)) bytes error-correcting word PO (Q is an integer of 1 or more);

the error-correcting word P bytes is added for each row of N bytes of the first error-correcting

processing block and each row of $(K \times (M + Q)$ is formed as $(N + P)$ bytes Reed-Solomon code PI;

whereby as an overall block, $(K \times (M + Q) \times (N + P))$ bytes error-correcting product code block is realized which constitutes K information data blocks $(K \times M \times N)$ bytes as information portion;

the sum of one information data block $(M \times N)$ bytes and an average word bytes added to the data block becomes a constant value $(M + Q) \times (N + P)$ bytes.

7. A data processing method, wherein the formation of $(N + P)$ bytes of error-correcting word PI according to claim 6 is such that in the creation of the PI series error correcting word of the information data block which has rows from the 0-th column to the $((N + P) -1)$-th which are composed of the 0-th row to the $(M-1)$-th row,

each row and each column are increased by one unit on the basis of the byte data on each of the front row so that the row number M obtained by the increase is rotated and arranged to move the row to 0-th row when the row as a result of the increase becomes M-th row thereby constituting M sets of PI series.

8. A data processing apparatus comprising a step of recording data on a recording medium through use of any of the processing method in any of claims 1 through 7.

9. A data processing apparatus, wherein means

for processing data through use of a method in any of claims 1 through 7 is provided in any of a communication apparatus, a data recording apparatus or an error-correcting apparatus.

10. A recording medium, wherein data is recorded by using a processing method in any of claims 1 through 7.

11. The recording medium according to claim 10, wherein identification information is recorded for identifying the processing method further as control information for data control.

12. A data processing method, wherein:

one matrix block is formed by aggregating a plurality of M rows × N columns of data sectors;

Y sub-blocks each having the same Y rows are formed by diving one matrix block; and

Y error-correcting word blocks PO-1 through PO-y are created with respect to data in the row (vertical) direction of Y sub-blocks respectively; and

one error-correcting code block (ECC) is formed in such a configuration in which the Y error-correcting word blocks PO-1 through PO-y are scattered and arranged in bytes at the end of Y sub-blocks, and an error-correcting word PI further is added in the column (horizontal) direction at the end of each row thereby constructing the ECC block.

13. A data reproducing method wherein:

digital data is processed in bytes to constitute one information data block in (M × N) bytes of M rows × N columns;

data is arranged in bytes in the information data block, so that data is arranged in the data transmission order from the 0th column to the (N-1)-th column for each row while data is arranged in the data transmission order from the 0th row to the (M-1)-th row;

(K × M) rows × N columns matrix block is further arranged which is a set of the information data block, and which is constituted of K information data blocks composed of information data blocks from the 0th information data block to the (K-1)-th information data block which continue in the data transmission order;

on each column of (K × M) bytes of the matrix block an error-correcting word PO-a (K × Q) or PO-a ((K/2) × Q) bytes is created with respect to only even-number data (K × M/2) bytes, and an error-correcting word PO-b (K × Q) or PO-b ((K/2 × Q) bytes is created with respect to only odd-number data (K × M/2) bytes;

PO-a and PO-b is scattered and arranged into K information data blocks which is constituted of (M × N) bytes of M rows and N columns;

each column of N columns is formed as (K × (M + Q)) or (K × (M + 2Q)) bytes of Reed-Solomon code PO (Q is an integer of 1 or more); and

the error-correcting word P bytes is further added for each row of N bytes and each row of (K × (M + Q)) or (K (M + 2Q)) rows is formed as (N + P) byte Reed-Solomon code PI;

whereby as an overall block an error-correcting product code block is processed which constitutes (K × (M + Q) × (N + P)) or (K × (M + 2Q) × (N + P)) bytes Reed-Solomon error-correcting word having K information data block of (K × M × N) bytes as information portion; the method comprising:

a step of carrying out a process of detecting and correcting a P I series error of the Reed-Solomon code PI;

a step of carrying out a process of detecting and correcting an error a PO series error of two kinds of Reed-Solomon codes PO.

14. A data reproducing apparatus, wherein data on the recording medium is reproduced by using a data reproducing method of claim 13.

15. A data reproducing apparatus, wherein means for processing data by using the data reproducing method of claim 13 is provided on any of a communication apparatus, a disk data reproducing apparatus and an error-correcting processing apparatus.

16. A data processing method, wherein:

digital data is processed in bytes to configure one information data block in (M × N) bytes of

M rows × N columns;

data is arranged in bytes in the information data block, so that data is arranged in the data transmission order from the 0th column to the (N-1)-th column for each row while data is arranged in the data transmission order from the 0-th row to the (M-1)-th row;

(K × M) rows × N columns matrix block is further constructed which is a set of the information data block, and which is constituted of K information data blocks composed of information data blocks from the 0-th information data block to the (K-1)-th information data block which continue in the data transmission order;

on each column of (K × M) bytes of the matrix block, an error-correcting word PO-b{(K/2) × Q bytes} is created with respect to the (k/2) × (mi + mj) bytes which is constituted by aggregating the even-number rows and the odd-number rows specified in the K information data block order, and an error-correcting word PO-b {(K/2) × Q} bytes is created with respect to the (K/2) × (mj + mi) bytes which is constituted by aggregating the remaining even-number rows and the odd-number rows specified in the K information data blocks;

PO-a and PO-b is scattered and arranged into K information data blocks which is constituted of (M × N)

bytes of M rows and N columns so that

each column of N columns is formed as two sets of Reed-Solomon code PO of $(K/2) \times (mi + mj) + Q)$ bytes and $(K/2) \times (mj + mi) + Q)$ bytes (however, M = mi (the number of even-number rows) + mj (the number of odd-number rows) and (Q is an integar of 1 or more)); and

the error-correcting word of P bytes is further added for each row of N bytes;

whereby as an overall block an error-correcting product code block is realized which constitutes $(K \times (M + Q)) \times (N + P))$ or $(K \times (M + 2Q) \times (N + P))$ bytes Reed-Solomon error-correcting word having K information data block of $(K \times M \times N)$ bytes as information portion.

17. The processing method according to claim 16, wherein when M is an even number, and Q is 1,

the even number rows of the even number-th information data block and the odd-number rows of the odd number-th information data block are aggregated to create the PO-a while

the odd number rows of the even number-th information data block and The even number rows of the odd-number-th information data block are aggregated to create PO-b.

18. The data processing method according to claim 16, wherein when Q is 2 or more, and the M is an

even number, the even number rows of the even-number-th information data blocks and the odd-number rows of the odd-number-th information data blocks are aggregated to create the Po-a while

the odd number rows of the even number-th information data blocks and the even number rows of the odd number-th information data blocks are aggregated to create PO-b.

19. The data processing method according to claim 16, wherein when Q is 2 or more and M is an even number, the even-number rows of all the information data blocks are aggregated to create the PO-a while the odd-number rows of all the information data blocks are aggregated to create the PO-b

20. A data processing apparatus, wherein:

digital data is processed in bytes to configure one information data block in (M × N) bytes of M rows and N columns;

data is arranged in bytes in the information data block, so that data is arranged in the data transmission order from the 0th column to the (N-1)-th column for each row while data is arranged in the data transmission order from the 0-th row to the (M-1)-th row;

(K × M) rows × N columns matrix block is further constructed which is a set of the information data block, and which is constituted of K information data

blocks composed of information data blocks from the 0th information data block to the (K-1)-th information data block which continue in the data transmission order;

on each column of $(K \times M)$ bytes of the matrix block, an error-correcting word PO-a$\{(K/2) \times Q$ bytes$\}$ is created with respect to the $(k/2) \times (mi + mj)$ bytes which is constituted by aggregating the even-number rows and the odd-number rows specified in the K information data block order, and an error-correcting word PO-b $\{(K/2) \times Q\}$ bytes is created with respect to the $(K/2) \times (mj + mi)$ bytes which is constituted by aggregating the remaining even-number rows and the odd-number rows specified in the K information data blocks;

PO-a and PO-b is scattered and arranged into K information data blocks which is constituted of $(M \times N)$ bytes of M rows and N columns so that

each column of N columns is formed as two sets of Reed-Solomon code PO of $(K/2) \times (mi + mj) + Q)$ bytes and $(K/2) \times (mj + mi) + Q)$ bytes (however, $M = mi$ (the number of even-number rows) $+ mj$ (the number of odd-number rows) and (Q is an integar of 1 or more)); and

the error-correcting word of P bytes is further added for each row of N bytes;

whereby as an overall block an error-correcting product code block is realized which constitutes

$(K \times (M + Q) \times (N + P))$ or $(K \times (M + 2Q) \times (N + P))$ bytes Reed-Solomon error-correcting word having K information data block of $(K \times M \times N)$ bytes as information portion.

21. A recording medium, wherein an error-correcting product code is recorded with the data processing method according to claim 16.

22. A data processing apparatus comprising a step of transmitting an error-correcting product code constructed with the data processing method according to claim 16.

23. A data reproducing method comprising the steps of:

receiving an error-correcting constructed with the data processing method according to claim 16;

subjecting the block to rearrangement of rows of the blocks; and

forming the rows to a set of rows in which two sets of Reed-Solomon codes PO are created to carry out each set of error correcting process.

24. A data reproducing apparatus comprising:

error-correcting means for carrying out each set of error correcting process by receiving the error correcting product code which is constructed in the data processing method of FIG. 16; and

means for reproducing each row that has been processed with the error processing means at

the arrangement position at the time of the error-correcting product code block.